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Title: *Coronal Heating Source*

Cluster: *Cross-Theme Theory and Data Analysis/SECTP*

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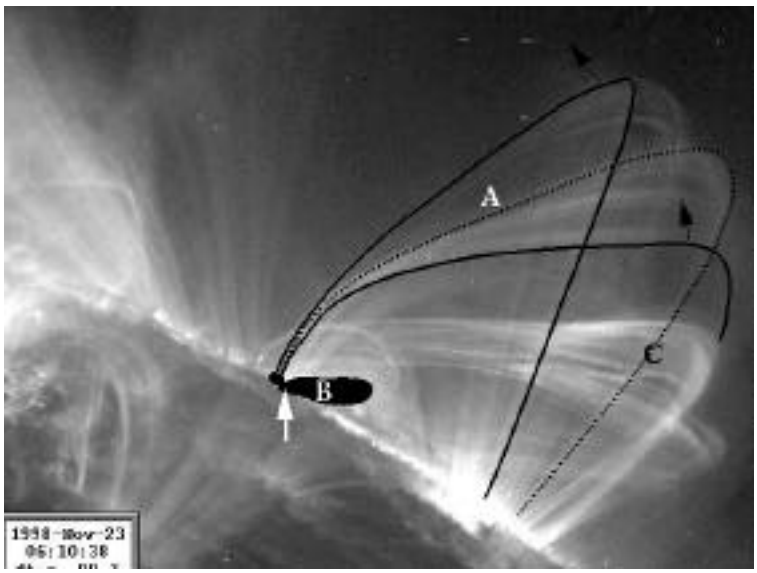
• Coronal Heating Source Prediction Over a Decade Ago Now Supported

Several studies in the mid 1980's, supported by the SEC Theory Program, at the University of New Hampshire, predicted that oscillating coronal active region loops would damp very rapidly. The idea was simply that waves are excited low in the solar atmosphere (by granular or supergranular motions, or by small reconnection events which give rise to "nanoflares"), propagate energy into the corona where they damp, converting their energy into heat. There has recently been a flurry of studies on damping mechanisms stimulated by observations from the Transition Region and Coronal Explorer, TRACE. What TRACE discovered was that nearby flares can set the coronal active region loops oscillating, analogous to the side-to-side oscillations of a guitar string which is tied at both ends. Very importantly the observed damping is very rapid, with an e-folding time of only a few wave periods. This rapid damping indicates that the energy is efficiently converted to heat, providing the coronal heating. This is consistent with the predictions made by the U. New Hampshire SECTP group in the mid 80's. For example, a recent paper by Goossens et al. (Astron. Astrophys., 394, L39, 2002), deriving the decay rate of the oscillating field lines through kink-wave resonance , recovered an earlier UNH result, stating "*Hollweg and Yang (1988) were the first to calculate approximate analytical expressions for the decay-times of quasi-modes and to apply them in a numerical example to solar coronal loops. The fast decay of coronal oscillations was predicted more than a decade before these oscillations were actually observed*".

This is a case in which the SEC Theory Program has produced understanding well ahead of its time. In this instance it is the origination of a concept that may well have much to do with the important "coronal heating problem." This is an important element of the Sun-to-Earth Space Weather coupling and understanding it is one of the principal goals of Space Science.



Annotated TRACE image of oscillating coronal loops. Letters refer to specific loops. From the TRACE web page: http://cvestige.imsal.com/TRACE/looposcillations/paper1/images/.

Reference: Hollweg, J.V. and G. Yang, Resonance Absorption of Compressible Magnetohydrodynamic Waves in Thin Surfaces, *J. Geophys. Res.*, **93,** 5423, 1988.